Extension Bulletin 313 1964

FAMILY AND FAR
DEFENS
HANDBOO

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U. S. DEPARTMENT OF AGRICULTURE

FAMILY AND FARM DEFENSE HANDBOOK

Table of Contents

IN THE EVENT OF NUCLEAR ATTACK

What to do	No advance warning	Alert signal°	Take cover signal†	Radio instructions‡
At home	Drop to floor. Get under bed or heavy table. Keep away from windows. Stay inside.	Turn on radio. Follow civil defense instructions.	Turn off appliances. Go to shelter. Turn on radio. Remain under cover.	When alert signal sounds, turn on your radio. This is essential for receiving latest emergency information and instructions.
At work	Drop to floor. Get under desk or work bench. Keep away from windows. Stay inside.	Turn on radio or other communications media. Follow civil defense instructions.	Obey civil defense instructions. Go to shelter. If possible turn on radio. Remain under cover.	Because of local conditions, plans for individual communities may differ. Know what instructions your community has has planned.
At school	Drop to floor. Keep away from windows. Cover face with hands.	Obey your teacher. Follow civil defense instructions.	Obey your teacher. Go to assigned shelter. Remain under cover.	
In the open	Drop to ground or dive for cover. Cover face with hands.	Go to nearest radio and listen for civil defense instructions.	Obey civil defense instructions. Go to nearest shelter. Listen to radio. Remain under cover.	Ask your local civil defense director for information on shelter, dispersal, and evacuation in your community.
In a vehicle	Drop to floor. Cover face with hands.	Turn on car radio or go to nearest radio for civil defense instructions.	Pull over to curb and stop. Obey civil defense instructions. Go to nearest shelter. Listen to radio. Remain under cover.	

° A steady 3- to 5-minute blast of sirens or whistles. Listen to radio—attack is impending.

† Wailing tone or series of short blasts continuing 3 minutes. Take cover immediately—attack is underway.

‡ Because of fallout radiation danger, stay in your shelter until otherwise instructed. Keep your radio tuned to the radio station giving information about your locality. It is your EMERGENCY BROADCAST SYSTEM station.

Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Luther J. Pickrel, Director of Agricultural Extension Service, University of Minnesota, St. Paul, Minnesota 55101. 50M—6-64

Family and farm emergencies can occur without warning. That's why you carry fire, automobile, and health insurance. But are you prepared to protect your family and farm in case of a widespread natural disaster? Floods, tornadoes, windstorms, and blizzards occur without warning in Minnesota; they will occur again. Now nuclear attack is also on the list of disaster possibilities.

Widespread disasters cause avoidable hardship and death, especially among people who are not prepared. But you can avoid them by being prepared; you can survive if you plan for survival. This handbook describes two emergency preparation plans—one for your family, another for your farm.

Since nuclear weapons create new and unfamiliar problems, the handbook is concerned with protection and survival during an all-out nuclear attack. This information is also pertinent for a natural disaster.

First let's look at the danger facing rural people.

About Fallout

No one knows what areas will be hit in a nuclear attack. Authorities assume the enemy will aim for large military installations and industrial centers. Rural areas are not likely targets, but they may be affected by fallout from explosions hundreds of miles away.

What Fallout Is

When a nuclear weapon explodes close to the ground, it causes thousands of tons of earth and debris to melt or vaporize. These materials are sucked into a mushroom-shaped cloud where they mix with radioactive materials from the bomb. High altitude winds carry this mixture until it condenses into a fine dust and falls to earth. **This dust is fallout.** It is dangerous because it contains large quantities of radioactive materials that give off rays harmful to living tissue.

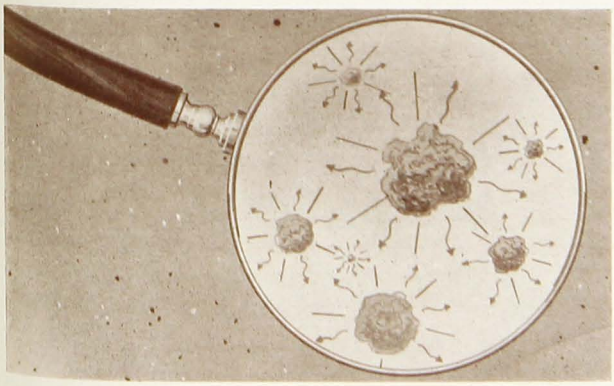

Figure 1. Fallout particles are like grains of dust or sand.

Characteristics of Fallout

You cannot smell or taste fallout, nor can you feel its rays. If fallout is heavy, you may see it in the air or on smooth surfaces. It looks like ordinary dust or sand. If fallout is light, it is invisible and detectable only with special monitoring equipment.

Where and When Fallout Settles

Where fallout settles depends upon the amount of rain and snow, air currents, topography, and, most important, the high altitude winds that carry fallout through the air. These winds may blow in different directions than ground winds.

Generally, fallout from one bomb settles in an elongated or crescent-shaped area extending downwind from the explosion center (figure 2). The pattern is extremely irregular in outline. Contamination within an area is usually not uniform; there may be local areas of extreme danger, others with very little contamination, and all gradations between. In addition, an area may receive fallout from more than one explosion.

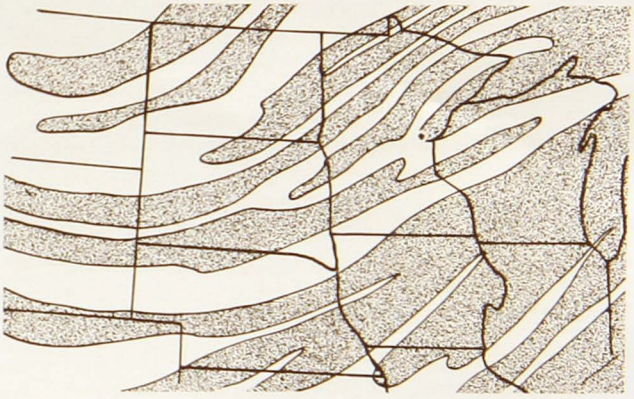

Figure 2. A possible fallout pattern covering the midwest.

Fallout takes time to settle. The heaviest particles begin descending near the target area about 30 minutes after the explosion. Lighter particles take longer to settle and may not affect some areas for 24 hours or more. About half the fallout comes down during the first 12 to 16 hours after the explosion, but dangerous amounts can continue falling for several days.

The Danger of Fallout

Each fallout particle is like a miniature X-ray machine and emits energy rays called gamma rays. This fallout radiation consists of mainly gamma rays and beta particles. Fallout radiation travels in all directions like light from an electric light bulb.

Gamma rays, like X-rays, can penetrate most materials including your body. When they do, they damage or destroy living cells and reduce the cells' ability to divide and grow. If many cells are destroyed, sickness and even death may result. However, thick layers of dense materials absorb nearly all the gamma rays before they can reach the other side. This is why a shelter built of heavy materials can protect you from fallout.

Beta radiation is not very penetrating, but if fallout dust gets on your skin and is not washed off, it can

cause burns. Ordinary clothing, a tarpaulin, or any cover that keeps out dust can protect against it.

Fallout radiation cannot make anything else radioactive. You cannot catch radiation sickness from another, and you can safely consume food or water through which fallout rays have passed. It is only when fallout particles get into food supplies that they become unusable. If you consume large amounts of food or water containing fallout particles and enough radioactive elements get inside your body, you will suffer internal burns. However, during nuclear attack, the danger of swallowing radioactive particles is far less than the danger of exposure to gamma radiation.

Radiation Is Not New

Fallout is not the only source of radiation. In your lifetime, you will be exposed to about 10 roentgens* from natural sources including cosmic rays from the sun and rays from radioactive elements in the ground. You will also be exposed to radiation from chest and dental X-rays and even to beta rays from luminous watch dials. These small amounts do no apparent harm; only if you are exposed to large amounts will you suffer ill effects. The effects you can expect from various amounts of radiation exposure are shown in table 1.

Table 1. Expected effects of exposure to fallout radiation

Exposure in roentgens in 4 days or less	Probable effects
Up to 50	No observable effects.
50-200	Some nausea and weakness. Medical care usually not required. May continue working.
200-450	Majority suffer nausea and a few days' sickness soon after exposure. A period of 1-3 weeks without further discomfort follows. After this time, there is loss of hair and moderately severe illness. Most people require medical care. More than half recover.
450-600	Same general symptoms and discomfort as above but more serious. Patients suffer extensive hemorrhaging and complicating infections. Less than half recover.
Over 600	Severe nausea and diarrhea until death which occurs within 2 weeks. Few survive.

Safeguards Against Radiation

Radioactive materials must "decay" by themselves; their radioactive properties cannot be destroyed. But time, distance, shielding, and decontamination are four safeguards against them.

* A roentgen is a unit for measuring radiation amounts.

Time is a natural safeguard because many of fallout's radioactive materials decay rapidly. Some lose half their strength in less than a day; a few decay at a much slower rate, taking years to lose even half their strength. On the average, fallout that gives off 1,000 roentgens per hour 1 hour after the explosion gives off 100 roentgens per hour 7 hours later. In 2 days it gives off 10 roentgens per hour and in 2 weeks 1 roentgen per hour. After that it loses its strength very slowly.

After 2 or 3 days you may be able to come out of your shelter for 1 or 2 hours if fallout is light. As it decreases, you may stay out longer. If you are in a heavy fallout area, you may have to stay inside 2 weeks or more.

Distance is a natural safeguard because radiation becomes less intense the farther you are from its source.

Shielding, putting a mass of material between you and fallout (figure 3), is the most practical safeguard.

Decontamination means removing fallout from a contaminated article to a place where it can do no harm.

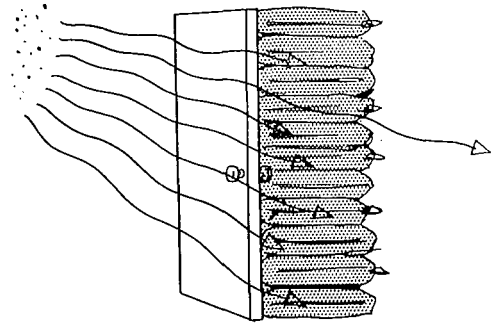

Figure 3. Thick shields of dense materials reduce the amount of radiation that can enter.

The Danger of Fires

In the event of nuclear attack, rural areas would not suffer as much fire damage as was once thought. Recent studies have shown that materials such as dry newspapers and grass would not ignite beyond 20 miles from the point of explosion.

However, you should be familiar with basic farm and home fire prevention and firefighting methods in case you are within 20 miles of an attack. A bomb may stray off its course and explode in a rural area, or fires may occur from causes unrelated to nuclear explosions.

Warning Signals and Information

Two civil defense signals warn of approaching enemy attack. When you hear the **alert signal,** a steady 3- to 5-minute blast, turn on the radio for information about impending attack. When you hear the **take cover signal,** a wailing tone or series of short blasts lasting 3 minutes, go to your shelter immediately because attack is imminent. These signals may be sounded on horns, whistles, or sirens. Regardless of the device used, you should be able to recognize each signal and know how to act.

Warning is a special problem for people living far from community centers. Even the most powerful sirens and horns do not have the necessary range. A number of makeshift warning systems including partyline telephones, signal lights, signal flags, and a system whereby one person drives to all neighboring farms can be devised. But none of these methods is practical for all rural areas. Until a system is perfected, the first warning of attack for many rural people may be intense light in the sky, an explosion, or both.

Regardless of the warning, authorized radio transmission will be your best means of receiving detailed information, advice, and instructions.

Keep your radio tuned to your Emergency Broadcast System station for local information.

Family Survival

Your family's protection during a disaster depends upon the plans you make beforehand. Precautions such as marking and stocking public fallout shelters are being taken by federal, state, and local governments, but there are survival plans you should make on your own. This chapter will guide you in planning for adequate shelter, equipment, food, water, health protection, and clothing for your family.

Shelter

The best way to shield your family from fallout, especially from gamma rays, is with a fallout shelter. Although there are public shelters, you may find that a family shelter meets your needs best.

Any building offers some fallout protection, and some locations in it provide better shielding than others. An underground shelter provides maximum protection.

Table 2. Amount of protection various shelters offer

Shelter	Percent of outside radiation admitted	Protection factor
Above ground in small wooden home	50	2
Above ground in homes with heavy masonry walls	10-50	10-2
Partially exposed basements of one- and two-story homes	10-50	50-10
Basements without exposed walls in one- and two-story homes	2-10	250-50
Basement fallout shelters recommended by civil defense authorities	0.4-2	250-50
Vegetable storage cellars	0.4-2	250-50
Underground shelters recommended by civil defense authorities	0.1 or less	1,000 or larger

In a single family dwelling you are safer in the basement than above ground because in the basement fallout radiation will come only from above, not from the sides. Above ground you are safer in the center of a building than near an outside wall.

For your home shelter, choose the most protected location in your home and add more shielding material to it or build a new shelter area. You can build increased protection into root cellars, storm cellars, and basements.

Most civil defense approved community shelters aim at a protection factor of 100. This means that shelter occupants receive only 1/100 the radiation that is outside. Your home shelter should also have a protection factor of at least 100. Table 2 shows the amount of protection various shelters offer.

Types of Shelters

Several types of home shelters are shown below. Some of them can be do-it-yourself projects costing about $150, others require the skill of a competent building contractor.

For full information on home shelter construction, ask your local civil defense director or your county agent for the booklet, *Family Shelter Designs* (H-7), prepared by the Office of Civil Defense. Building supply dealers and contractors can also give you advice and plans for home shelters. Your county agent can tell you about plans available from the Minnesota Agricultural Extension Service. Plans for figures 7, 9, 10, and 11 shown below are in *Family Shelter Designs*, the plan for figure 6 is an adaptation of the plan on page 23 of *Family Shelter Designs*, and plans for figures 4, 5, and 8 are available through your county agent.

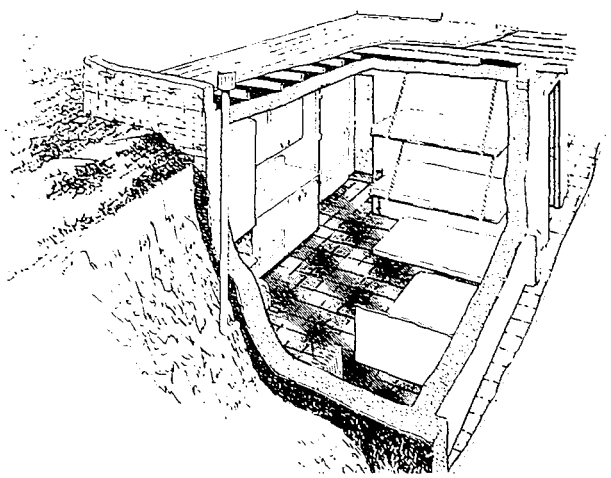

Figure 4. Basement shelter for six to be built with a new home.

This basement shelter for six persons is intended to be built with a new house. It should be built in the corner of the basement where earth on the outside wall reaches the ceiling. Advantages of this shelter include multiplicity of functions, flexibility of shape, and use of materials and labor that tie in with the house's construction. Its protection factor is 100.

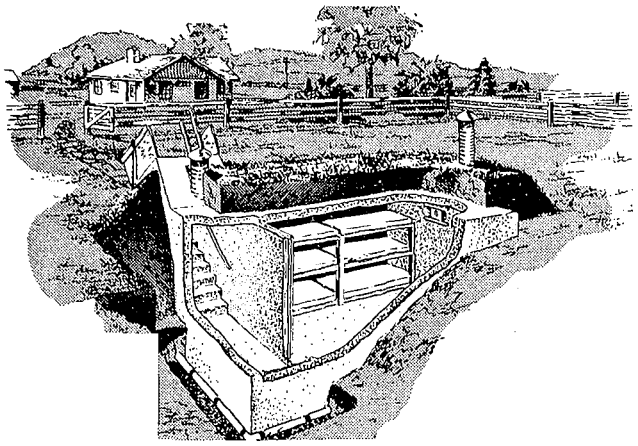

Figure 5. Backyard underground shelter for six.

This backyard underground shelter for six persons is similar to a cyclone cellar except for its heavier construction and reinforced entrance. It can be used as a storm, storage, or fallout shelter. Main advantages are flexibility of shape and multiplicity of functions. Protection factor is about 2,600.

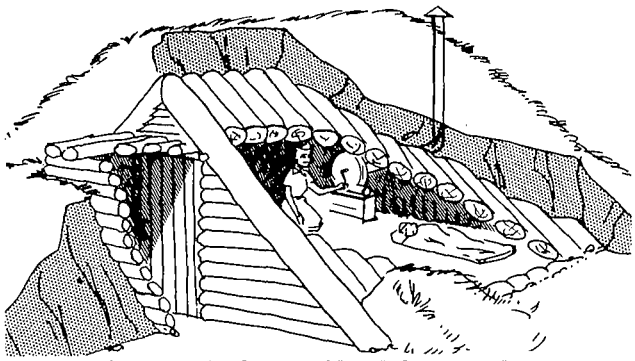

Figure 6. Earth-covered log shelter for eight.

This aboveground earth-covered log shelter for eight people is especially suited for areas where logs are available. Only a small portion provides standing room, but almost the entire structure allows space for sitting and storage. Principal advantage is that it can be built in areas where the ground water table is near the surface. With a 2-foot earth cover and sufficient shielding near the entrance, this shelter's protection factor can reach 500.

Figure 7. Basement sand-filled lumber lean-to.

The basement sand-filled lumber lean-to pictured in the lower left-hand column will provide protection for three persons. The house itself gives partial protection and sandbags block the ends of the shelter. Advantages are low cost, simplicity, and general availability of materials. Protection factor is at least 100.

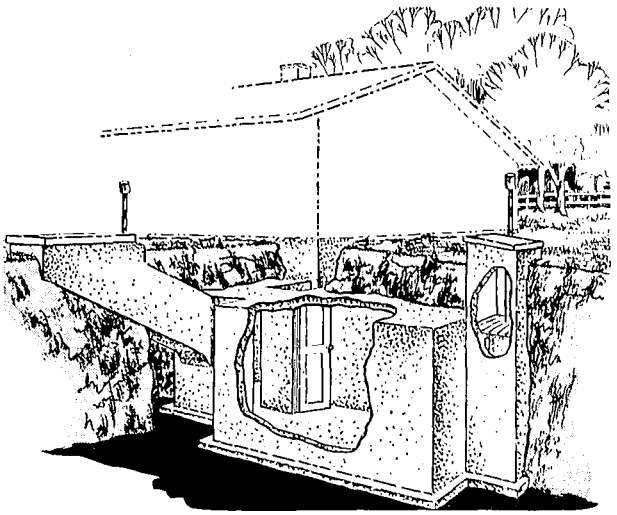

Figure 8. Reinforced concrete shelter for six.

This reinforced concrete structure for six people is built below ground and covered with about 3 feet of earth. Located outside the house, it can be reached from the basement. It has ventilation, electrical outlets, an emergency exit, and storage space for fruits and vegetables. The main advantage is flexibility of shape. Protection factor is over 1,000.

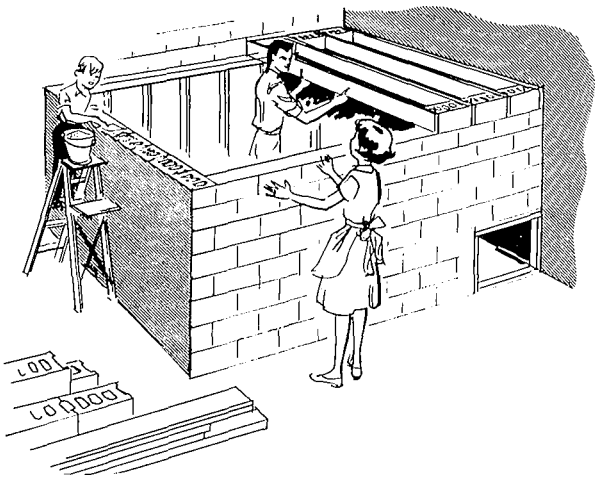

Figure 9. Sand-filled concrete block shelter.

This sand-filled concrete block shelter will provide low cost protection for four persons. It is intended to be installed in a belowground basement. Advantages include simple design, speed of construction, and availability of materials. Protection factor is at least 100, but by adding a baffle wall protection can be increased. By increasing the ceiling height to 6 feet or more this shelter can serve as a dual-purpose room.

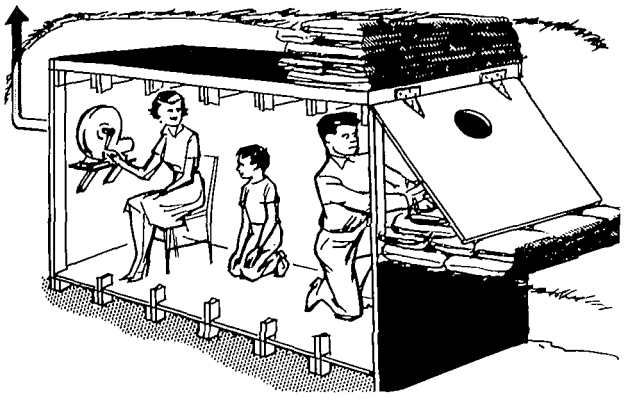

Figure 10. Three-person backyard plywood shelter.

You can build this three-person backyard plywood shelter partially above ground and mounded over with earth or totally below ground. Advantages include general availability of low cost materials and ease and speed of construction. Protection factor is about 500 if the earth cover is 2 feet deep and a 2-foot thick entryway shield is formed with sandbags.

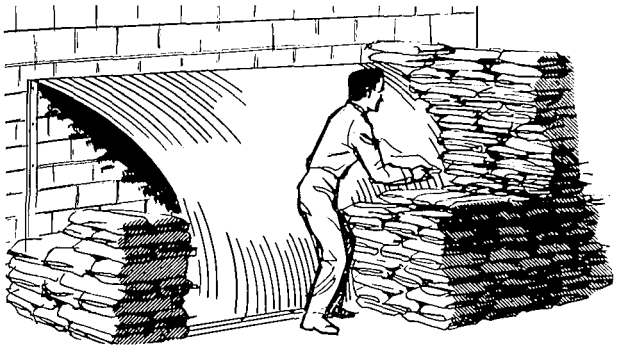

Figure 11. Four-person basement-corner shelter.

This four-person basement-corner shelter is made of corrugated asbestos cement sheets covered with sandbags. Construction time is less than 20 hours and cost is about $150. Advantages are adaptability to the dimensions of most basements and ease of construction. Protection factor is at least 100.

In planning a home shelter, consider these factors:

Radiation shielding. Choose construction materials that offer the most protection from radiation. The heavier and denser the material between you and fallout, the less radiation you'll receive. Remember, your shelter should have a protection factor of at least 100.

Fire resistance. In constructing your shelter, use as few combustible materials as possible. Use noncombustible furnishings and storage containers and cots instead of mattresses.

Space. Provide at least 10 square feet of floor space per person. No shelter should have less than 25 square feet of floor space. The height should be at least 4 feet.

Ventilation. Mechanical air blowers are optional in basement shelters since air will enter through door cracks and other crevices. Fallout dust is not likely to enter through these cracks in any considerable amount because most of it will be stopped by the house above. Underground shelters need ventilation systems. One simple system consists of a 3-inch intake pipe, a hand-operated blower, and an exhaust pipe. The intake pipe should extend at least a foot above ground and be covered with a weather cap, or have two right-angle bends to stop fallout particles.

Lighting. Make provisions for continuous low-level lighting. Electric power stations may continue to function after a nuclear attack, so you can install light and power outlets from your home electrical circuit. But keep a storage battery in the shelter in case central electrical power fails. Increase the effectiveness of your lighting by painting the shelter ceiling white and installing metallic foil reflectors behind light bulbs. Flashlights and battery lanterns will provide brighter light for reading and emergencies. Do not use kerosene- or gasoline-burning lanterns in the shelter because they burn oxygen and give off fumes.

Drainage. Since drainage problems differ with location, obtain reliable local advice before building an underground shelter.

Heating. In moderate weather, the body heat of inhabitants will keep the shelter warm. For cold weather, install an electric space heater. Also stock the shelter with extra blankets and clothing in case electric power is unavailable. Do not use fuel-burning space heaters as they give off carbon monoxide.

Doors and windows. For a basement shelter, use heavy shielding material to block windows. Unless you plan to block the shelter entrance with sandbags or cement blocks during occupancy, build a baffle wall in front of it. Since nuclear radiation travels mostly in straight lines, the right angle turn of the baffle wall will stop most radiation from coming through the shelter entrance.

Storage space. Make provisions for storage shelves and compartments for special equipment. Make space allowances for ventilation pumps, water storage containers, firefighting equipment, and cots. If you use bunks instead of cots in a basement shelter, put them in before the walls are completely built or you may not get them through the narrow passage left by the baffle wall.

Improvised Shelter

A permanent shelter is more satisfactory than an improvised one because it offers greater protection and is ready for use even if warning time is short. If attack comes before you have built your shelter, remember these guidelines for improvising last-minute protection:

- Basements usually provide better shelter than aboveground floors. In large buildings the cen-

tral areas of middle floors offer good protection.

- A corner of a belowground basement is better than the center.
- On aboveground floors, improvise shelter away from outside walls.
- Keep the shelter small. Concentrate the shielding mass immediately around and above you to save construction time.
- Stay away from windows. They are weak points in your fallout shield.

Before fallout starts, get your family into the shelter. Stay there as much as possible until you are informed it is safe to come out for short periods. It is especially important to stay in your shelter for the first 2 days.

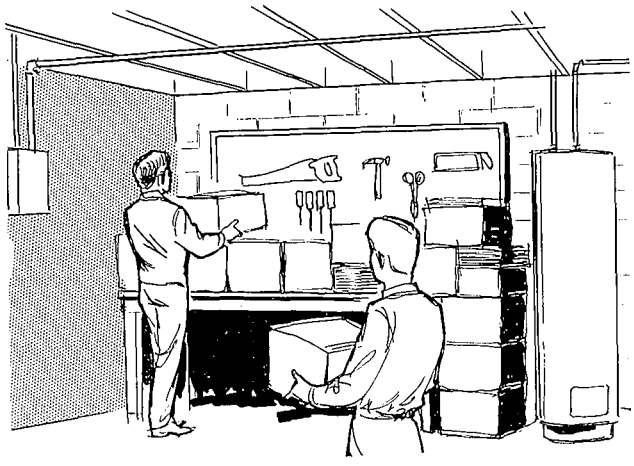

Figure 12. A shelter can be improvised around a workbench.

An improvised shelter can be made in a basement corner by stacking heavy material on top of and around the open sides of a workbench (figure 12). Pile dirt and other heavy material in basement window wells for increased protection.

The more warning time you have the better the shelter you can improvise. Here are directions for a shelter (figure 13) that takes about 6 hours to prepare.

In the best protected corner of your basement place a wooden beam (4" x 4") crosswise below the joists to reinforce the middle of the above floor. Support the beam with postjacks or other posts placed on short pieces of plank on the basement floor. Then fill the room above the shelter to the depth given with one or a combination of the materials shown in figure 15. Other materials may be used to obtain 90 to 100 pounds of material per square foot of floor space.

Enclose an area of the basement corner by building temporary walls from bagged fertilizer, vegetables, grain, dirt, feed, or baled hay. (If baled hay is used, walls should be at least 9 feet thick.) Allow 10 square feet of floor space per person. Place the bags crossway in wall and crisscrossed at ends and corners for better stability. Make an entrance near an existing basement wall. Cover windows in the shelter area with any of the materials mentioned below.

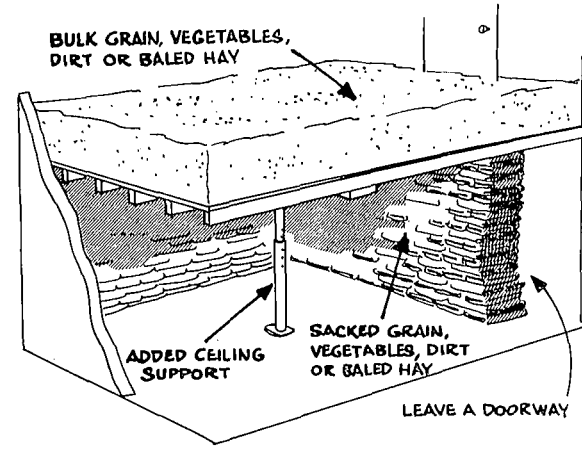

Figure 13. Farm materials can be used to build a basement-corner shelter.

Another shelter can be made by leaning lumber or doors from your house against a basement wall or an inside wall on the first floor (figure 14). Fasten bottom edges of lumber or doors to the floor or brace them against the opposite wall so they cannot slide. Cover them with about 2 feet of bagged earth or 3 feet of sacked grain or similar materials. If your shelter is against a first floor wall, place heavy furniture or a pile of earth or grain against the other side of the wall to the height of the leaning doors. Then place a table lengthwise out from the wall at each end of your lean-to. By putting boards against the table legs on the outside, you will have a crawl-in and ventilation tunnel at a right angle to the shelter. Cover the top and side of each table with earth, grain, or other material.

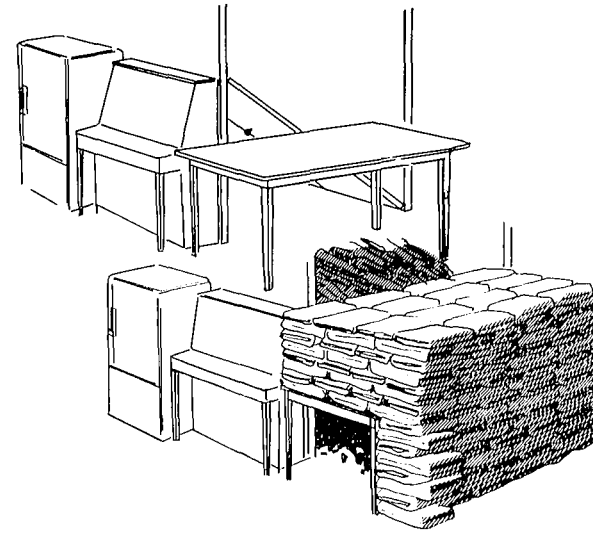

Figure 14. Inside doors, lumber, and furniture can be used to improvise fallout protection quickly.

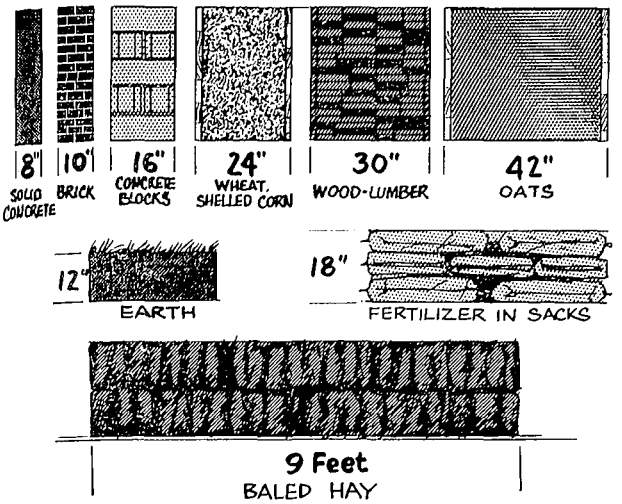

Figure 15. *These materials in these amounts offer the same shielding protection as 8 inches of solid concrete.*

Equipment for Emergencies

Although you may be able to leave your shelter briefly after 2 or 3 days, prepare to be completely self-sustaining for at least 2 weeks. Make plans for equipment, food, water, clothing, and other essentials to carry you through an emergency.

Select equipment carefully, since unnecessary items will take up valuable shelter space. Use the checklist at the end of this handbook (table 7) for keeping a record of equipment and supplies.

Store equipment in an accessible place that will protect it from dirt, moisture, and mechanical damage. Your fallout shelter is the best storage place, but you can keep equipment in the basement, garage, cabinets, or utility room provided each family member can get his assigned items into the shelter quickly.

Here's a checklist of equipment you'll need for your shelter:

For Cooking and Serving

Canned heat or a camp stove. Camp stoves that burn gasoline or kerosene can be used in the basement, but not in a shelter because they use oxygen and give off carbon monoxide.
Serving dishes and cooking utensils. Include a paring knife, large spoon, fork, and measuring cup.
One or two cooking pans.
Pot holders.
Aluminum foil. Use it for wrapping leftovers, lining pans to lessen dishwashing, and dividing pans to heat several foods at once.
Disposable knives, forks, spoons, plates, cups, and napkins. Estimate how much you'll need for 2 weeks. Plastic dishes and tableware may be used, but water for washing them may be limited.
Can and bottle openers.
Medicine dropper for measuring water purifier.
Matches.
Powdered soap and dish towels.

For Communication and Radiation Detection

Portable radio and spare batteries. Batteries for transistor radios usually do not wear out as fast as those for regular portables. Check the radio reception in your shelter to determine if an outside antenna is necessary.
Radiation meters. A citizen's kit containing instructions and instruments for measuring radiation intensity and total doses is available through department stores for $25.

For Lighting

Waterproof flashlight with extra batteries.
Six-volt dry cell lantern with spare battery.
Candles.
Lanterns with extra wicks and fuel. Kerosene and gasoline lanterns should not be used in a small shelter because they use oxygen and give off fumes. A dim light can be made by wiring a 6-volt 0.15 or 0.25 ampere pilot lamp to a 6-volt lantern battery. A good quality "hot-shot" battery will provide light about equal to a candle for 10 to 14 days. (These bulbs and sockets are available at electrical and radio repair shops.)

For Sleeping

Bedroll or sleeping bag for each person.
Extra blankets.
Plastic sheets, oilcloths, or canvas covers to prevent mildew during storage and to use as ground cloths.

For Sanitation

Large covered container such as garbage can or 10-gallon milk can.
Covered pail.
Toilet tissue.
Disinfectant.
Plastic and paper bags.
Sanitary napkins.
Wash basin.
Soap.
Paper towels.

For Baby

8 to 10 nursing bottles and nipples.
Metal funnel.
Measuring spoons.
Measuring cup.
Pan for mixing.
Kettle for sterilizing equipment.
7 clean towels or feed sacks.
7 dozen disposable diapers.
Soap.
Wash cloths.
Towels.
Emulsion or talcum powder.
Safety pins.
Toilet and cleansing tissues.
Blankets, warm clothing.

Other Items

First aid kit and prescription medicines.
Sewing kit.
Screwdriver, pliers, hatchet, shovel.
Broom.
Recreational supplies including magazines, games, song books, puzzles.

Water

Water systems might be shut down or their supplies contaminated during an emergency. Since many rural homes will not have water if electric power fails, you should have a 2-week supply near your shelter.

You'll need at least a half gallon of water a day for drinking and food preparation. This amounts to about 7 gallons per person for a 2-week period. If you want water for bathing, brushing teeth, and washing dishes, store another 7 gallons per person. For each child under three, store another 2 gallons for bathing and laundry.

Storing and Replacing Water

Clean plastic or glass jugs, fruit jars, or bleach bottles are good storage containers if their lids fit tightly. Metal containers are safe to use, but they may give water an unpleasant taste. Protect glass containers from breakage and light by packing them in newspapers, excelsior, or other padding material.

Since drinking water may develop undesirable tastes and odors during storage, check the supply every 3 months and change it when necessary.

If an emergency warning comes and you have not stored any water, quickly collect it in pots, jars, bottles, and jugs. Fill the bathtub and sinks and cover with plastic to keep out dust and fallout.

Sources of Water

Water-packed fruits and vegetables are good liquid sources if containers are undamaged. Fresh fruits, especially citrus fruits, are also good sources, but wipe and peel them before use.

Once you can leave the shelter, part of your water needs can be met with reserves right in your home. Melted ice cubes and frost in your freezer will add a small amount. You can drink the water in the water heater, pipes, and flush tanks on toilets if you shut off the main valve into your home so that contaminated water cannot enter. Get water from the hot water heater by opening the drain cock at the bottom of the tank. For safety, turn off the water heater's gas valve or electric power.

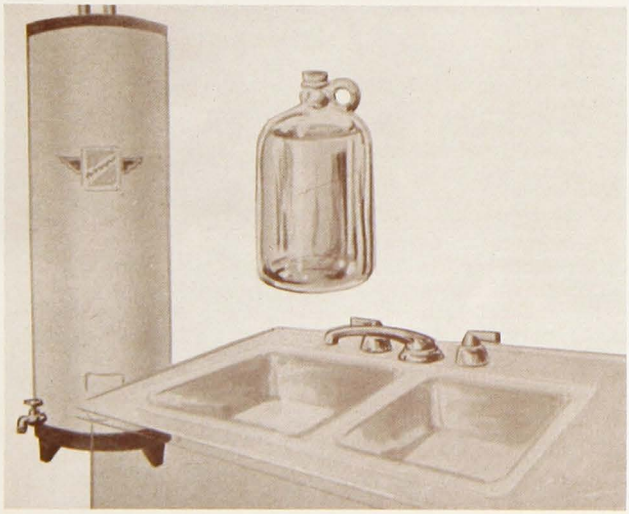

Figure 16. These can be sources of fallout-free water.

When you can go outdoors, you'll find safe water in sealed and covered wells. A cistern can be a water source if it is not contaminated with fallout particles washed from the roof. If your cistern is not in regular use, you can store well water in it, but pump out and refill it at intervals. Water from springs, farm ponds, and creeks should not be used unless authorities confirm its safety or you know how to make it safe.

Purifying and Decontaminating Water

Making water safe after a nuclear attack involves two processes: freeing it from germs (purifying it) and freeing it from radioactive fallout (decontaminating it). If you suspect that your water contains germs, purify it by:

Boiling. The safest way to purify water is to boil it vigorously for 2 minutes. Add a pinch of salt or pour the boiled water from one container to another several times to improve the taste.

Bleaching. Any liquid household bleach containing hypochlorite, a chlorine compound, as its only active ingredient purifies water. Add bleach to water, stir or shake vigorously, and let stand 30 minutes. The water is pure when it has a distinct chlorine taste or smell. The following table shows the amount of bleach to use.

Table 3. Amounts of bleach needed to purify water

Amount of water	Bleach needed to purify	
	Clear water	Cloudy water
1 quart (¼ gallon)	2 drops	4 drops
1 gallon	8 drops	16 drops
5 gallons	½ teaspoon	1 teaspoon

Iodine method. Use ordinary household tincture of iodine to purify small quantities of water. Add 3 drops to each quart of clear water, 6 drops to each quart of cloudy water. Stir thoroughly.

Tablet method. Water-purification tablets that release chlorine or iodine purify water. They are available at most sporting goods and some drug stores. Follow package directions.

Water from cisterns and open sources such as uncovered wells, farm ponds, and creeks may be both impure and contaminated. If you must use it, know how to make it safe. A flower pot makes a simple and effective filter for removing fallout. Cover the bottom of the pot with a screen, cover the screen with two or three sheets of paper tissue or cloth, then 2 or 3 inches of subsoil, humus and clay, and 2 or 3 inches of small rocks. This type of filter will remove more than 90 percent of all radioactive materials.

Other methods of decontaminating water include straining it through several thicknesses of clean cloth or paper towels, mixing a handful of clay soil with each gallon of water and allowing it to settle out for a day, and running the water through a home water softener.

The latter method will remove up to 99 percent of all radioactive materials.

After you have filtered the water to remove fallout, you must purify it by one of the methods described previously.

Food

Whether you live in the country, a city, or a suburb, you should keep a 2-week food reserve on hand. Your reserve should:

Consist of familiar foods because they are more heartening in times of stress.

Require no refrigeration and minimum cooking.

Be completely edible, hot or cold.

Include lightly-seasoned foods to decrease water needs. Salted nuts, ham, and fish increase thirst.

Include food for babies, invalids, and persons on special diets.

Include canned foods in sizes that will serve your family for one meal, eliminating the problem of storing leftovers and preventing waste. This is especially important for foods that deteriorate rapidly after being opened.

Leave a minimum of garbage and give off no strong, unpleasant odors.

Table 8 lists the kinds and quantities of food suitable for a reserve supply. If your family consists of four adults, store four times the amounts suggested. Teenagers need more than these amounts, younger children less. Use table 9 as a checklist for keeping a record of your food reserve.

Storing and Replacing Your Reserve Supply

The Office of Civil Defense recommends two ways to store your reserve food: increase your regular food supply until it contains a built-in 2-week reserve, or store and maintain a special 2-week stockpile in your home or fallout shelter.

If you choose the first method, keep a list of foods you use and replace the food regularly. If you choose the second method, keep foods in their original containers and store them in a dry place not above 70° F. and not below freezing. Even foods wrapped in paper should be kept in their original wrappers, but the entire package should be placed in a metal container or wrapped in plastic and sealed with tape. Use a potato chip can or a 10-gallon milk container for storing foods packaged in paper. Once packages are opened, use such a container to keep the food fresh. Be sure all cans and packages are labeled with the purchase date since you'll need to replace everything about once a year. Use replaced foods for family meals and put fresh supplies at the back of the stockpile, keeping older supplies in front.

Concentrated foods. You can purchase multipurpose foods and food kits designed for shelter storage. Nutritional, concentrated foods that can be used as food extenders and fortifiers are also available. The latter are easy to store and make a good supplement to your food supply, but remember that adding large amounts of them will increase the amount of water you'll need.

Frozen foods. If your home freezer is close enough to your shelter, you can use the foods in it. Even if the power should go off, the food in a well-insulated freezer would not spoil for several days. Food in small freezers spoils sooner than that in large ones. Once you open the freezer use the food in it as quickly as possible. Destroy immediately any food showing signs of spoilage.

Precautions in Preparing and Serving Food

Since cooking will not destroy radioactivity, wash all foods exposed to fallout. Do not consume any food from packages left open during fallout. Wash or wipe cans and packages thoroughly to prevent fallout from contaminating the contents. Foods with undamaged peels or rinds will be safe to eat if you remove the peel or rind carefully so that no fallout gets on the inner food. Wash leafy vegetables thoroughly and don't use them until you're sure they are free of fallout. Pulling off the outer layers of cabbage and lettuce heads will remove significant amounts of radioactivity.

Estimate closely the amount of food to prepare in order to eliminate leftovers and reduce the time between preparation and serving.

The close living required in a shelter encourages the spread of disease, so follow these every day health precautions in food preparation—don't taste food from the cooking spoon, wash your hands each time you use the toilet, and don't handle food when you have a cold or sores on your hands.

Dishwashing

Ideally you should scrape cooking and eating utensils, wash them in hot soapy water, rinse them in hot water, and sterilize them in boiling water for 2 minutes or dip them in water containing a few drops of 5-percent chlorine bleach. But you may not have enough water for thorough dishwashing, so reduce the number of dishes you dirty by using paper plates and eating from containers. Use paper towels to wipe grease from utensils and aluminum foil to line pots and dishes.

Clothing

Although clothes cannot shield you from gamma radiation, they can protect you from burns caused by fallout particles. If you must go outdoors while fallout is in the air, cover yourself completely. Wear a hat and neck scarf and tie the bottoms of your slacks over your boots and the ends of your sleeves over your gloves. Polyethylene film offers more protection than woven or

knitted fabrics, but do not put it over your face. If there is much dust, wear goggles and a filter mask. Before reentering the shelter, remove contaminated clothes, wash exposed body areas, and put on clean clothes. Do not bring contaminated clothes into the shelter.

Since there may be no heat in your home, choose warm clothes—coats, slacks, boots, gloves, scarves, and caps. Also choose clothes that are comfortable—loose-fitting garments are easy to wear over an extended period.

The kind and amount of clothes you choose depend on your family size, individual taste, and storage space available. If you store clothing in your shelter, pack it in metal closets, trunks, footlockers, or heavy cardboard boxes and make sure it is protected from dampness. If you do not have a shelter, keep your emergency clothes in a suitcase in the closet. If this is impossible, keep a list of necessary items and attach it to a closet door.

Health Protection

Staying healthy is especially important under emergency conditions. Bodily injury, radiation sickness, vermin, and contagious diseases are among health problems you may have to face. Your best emergency health protection is taking care of yourself now—have regular checkups and keep tetanus, smallpox, polio, and diphtheria immunizations up to date. Also, be prepared to give first aid, treat radiation sickness, keep sanitation at a high level, and decontaminate your home after an attack.

First Aid

A first aid kit containing the supplies listed in table 10, prescription medicines, and a good instruction booklet belong in your shelter. Arrange the contents in a metal box so you can find what you need without unpacking the entire box, and store it out of children's reach. Consider any family allergies when you are stocking your kit. Renew supplies every few months. If you cannot keep a first aid kit in your shelter, at least keep all supplies where you can find them easily.

To use your first aid kit effectively, be sure one adult in your family has had either first aid or medical self help training. A first aid course teaches what to do until the doctor arrives; a medical self help course includes lessons on maintaining sanitary shelter conditions and acting when a doctor is not available. Your local civil defense director can tell you where and when such courses are offered.

Treatment for Radiation Sickness

Your body can withstand some radiation without serious permanent injury. But if you are exposed to too much radiation too fast, radiation sickness and possibly death will result.

If someone in your family develops radiation sickness, make him rest. Give him aspirin for headaches and motion-sickness tablets for nausea. Have him sip salt water (1 teaspoon of table salt to 1 quart of cool water) as soon as possible for diarrhea and vomiting, but not until vomiting has stopped. For a sore mouth, have him use a salt water mouthwash.

Human Waste Disposal

During emergencies good sanitation is not only a matter of comfort, but also an important health precaution.

Your first task will be to make temporary toilet provisions. A metal pail with a tight cover can serve as a simple shelter toilet. A better device can be made by cutting the seat out of a chair and placing the chair over a pail. Hang an old shower curtain around the improvised toilet to provide privacy. You'll need a supply of plastic bags to use as pail liners, household bleach or creosol to control odors and insects, and a large garbage can or a 10-gallon milk can for storing used plastic bags. After you've been in the shelter for about 2 days, move the large can outside. Once you can go outside safely, bury wastes under 1 or 2 feet of earth.

In emergencies where fallout is not a hazard, construct a temporary pit toilet or use an existing privy—both are effective means of waste disposal over extended periods of time. Cover accumulated waste with 1 to 2 feet of earth when the toilet is moved or abandoned. To prevent wastes from contaminating water, make sure outdoor toilets are at least 50 feet away from any well, spring, or other water source.

Keep extra toilet tissue and a supply of sanitary napkins on hand. If your family requires rubber sheeting or other special sanitary equipment, make sure you have adequate supplies. Store at least a week's accumulation of newspapers for sanitary uses, for insulating bedding from floors, and lining clothes against cold.

Sanitation for Baby

Diaper laundering may be impossible during emergencies, so keep disposable diapers on hand. If you have none, make emergency diapers by lining rubber pants with cleansing tissue, toilet paper, scraps of cloth, or other absorbent materials. Or, cut and fold to diaper size any moisture-resistant cloth and line it with absorbent material.

Garbage Disposal

Wrap garbage in several thicknesses of newspaper to absorb moisture and reduce odors. Then place in a covered can. Bury it as soon as you can go outdoors.

Vermin Control

Every few months paint or spray your shelter with a 5-percent solution of DDT or another insecticide containing chlordane, dieldrin, Diazinon, or ronnel—taking care against inhalation or skin contact. Eliminate lice

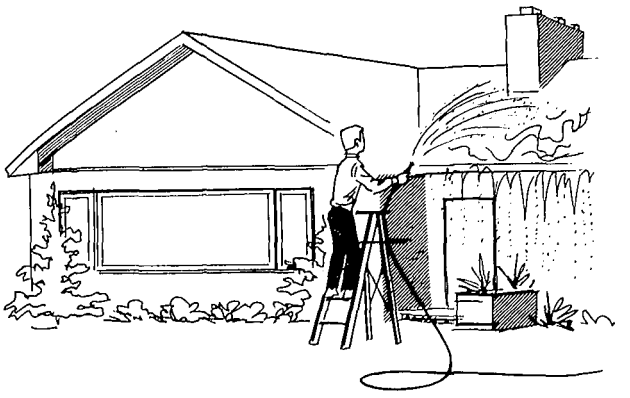

Figure 17. Fallout washed from buildings should be flushed to where it can do no harm.

and other body infesting insects with a 10-percent DDT dust left on the body and in clothing for 24 hours. Include screening material (cheesecloth), a fly swatter, and mouse traps in your shelter supplies. Do not use spray insecticides in an occupied shelter—they may injure eyes and lungs or explode.

Decontamination After an Attack

After all fallout is down and it is safe to go outdoors for a short time, decontamination measures will begin. The extent of a community's decontamination work will depend on the amount of fallout and the number of people available to help. Local governments will organize work units to perform necessary duties; you will probably be asked to help.

Local authorities can advise you about necessary decontamination around your home. You may want to wash off your roof, porch, and outside walls. But remember that fallout washed from the house will land on the ground and must be flushed to a safe area with a high-pressure hose.

Decontaminate your home's interior by vacuum cleaning or scrubbing with soap and water. Vacuum clean your floors, rugs, and furniture; scrub tables, walls, floors, and other hard surfaces. Do not attempt to decontaminate upholstered furniture by scrubbing—water will only carry fallout particles deeper into the material.

Do not expose yourself unnecessarily to fallout radiation. Cover yourself completely during decontamination operations; before reentering the shelter, remove contaminated clothing, wash exposed parts, and put on clean clothing. Don't bring contaminated clothing into the shelter.

Occupying Your Family's Time

When preparing for shelter life, plan activities to help pass the time quickly, take your family's minds away from worries, and help prepare them for life outside the shelter.

Reading Material

Reading time will be ample in a shelter, so store plenty of reading material suitable to your family's ages and interests. Your supply may include a Bible, familiar storybooks, novels, nonfiction books, a collection of poems, magazines, books of riddles, brain teasers, and crossword puzzles. Since your family will probably be curious about what has happened and what to expect when they leave the shelter, be sure to include civil defense brochures and this handbook with your reading material.

Games and Toys

Table games for children and adults, and simple toys for very young children will occupy idle hands. Favorite toys will represent the normal secure world to young children.

Games should be as different from each other as possible and so absorbing they divert attention from worry. Because you'll be under tension, choose games that are not likely to create much noise or cause arguments. Card games, board games, pencil-and-paper games, and games that require only limited space are suitable. Jigsaw puzzles and games that can be played by one or several people are especially appropriate.

Music

Singing can help keep spirits high during periods of stress, so include songbooks in your supplies. You may even want to store toy instruments, harmonicas, or other small instruments to accompany singing and for exercising.

Hobbies and Handicrafts

Hobbies and handicrafts requiring limited space can be carried on in a shelter, but remember that the bright light required by some handiwork may not be available. Store blocks and other construction toys for young children.

Exercise

When you leave the shelter, you may have to do heavy physical work, but living inactively in limited space can result in stiff muscles and physical weakness. So plan a program of regular, simple exercises for shelter living. Avoid strenuous exercises to prevent raising the shelter temperature or stimulating appetites.

Continuing Family Routine

Children who cannot understand their confinement will need reassuring activities. If you continue familiar practices such as taking naps, being responsible for certain chores, saying grace before meals, and having Dad read to them at bedtime, they will feel a continuation of normal family life.

Planning for Life Outside the Shelter

Your family should discuss the probable situation outside the shelter, the dangers of postattack environment, and family needs. You can devise games that teach children to avoid touching contaminated objects. Your family should be thoroughly familiar with the dangers of fallout before anyone goes outside.

Livestock Care and Survival

To continue producing food for your own and the country's survival, you must safeguard your farm and livestock as well as your family. The next two sections will suggest practical steps you can take to safeguard your livestock and crops from the effects of fallout.

Livestock are an important emergency food source. Special precautions must be taken to protect them from fallout. Like humans, animals can be injured by exposure to both gamma and beta radiation. Gamma rays can penetrate their bodies and damage or destroy tissue; beta rays can cause external injury if sufficient fallout collects on their hides and they may suffer internal injury if they eat fallout particles.

Cattle, sheep, and hogs react similarly to total gamma radiation exposure. They are usually healthy for several days, listless and depressed for 4 or 5 days, then irritable and feverish with acute skin sensitivity and little appetite. Other symptoms are diarrhea (especially in cattle and sheep), vomiting, excessive salivation, hemorrhaging, and loss of coordination and equilibrium. Few animals die when exposed to less than 250 roentgens, few survive after exposure to 1,000 or more (table 4). Very young and very old animals are especially sensitive.

Table 4. Mortality of unsheltered animals after 24-hours' exposure to various radiation doses*

Species	Percent of mortality				
	100	80	50	20	0
	exposure dose in roentgens				
Cattle	650	600	500	450	300
Sheep	700	600	525	450	350
Swine	800	700	600	450	350
Poultry	1,200	1,100	900	600	400

* Reproduction of table 2 in *Protection of Food and Agriculture Against Nuclear Attack*. Agricultural Research Handbook No. 234. USDA, p. 11.

The effect of fallout on animal genes and fertility should not be a serious problem because radiation doses large enough to cause permanent sterility also cause death. Both male and female animals exposed to radiation and observed for several years showed no signs of permanent sterility even after exposure to near-fatal doses.

If animals are not exposed to enough gamma radiation to cause death, they will not usually get enough fallout on their coats nor will they eat or drink enough contaminated feed and water to cause serious injury or death. However, fallout particles lodged on hides may cause beta burns on the skin. These appear as discolored areas on the coat, flaky skin areas, or deep skin burns with swelling, weeping, and hair loss. Several days or weeks may pass before beta burns become visible. Experiments indicate that sheep are naturally protected from these burns because beta particles do not penetrate their thick coats.

Animals grazing on contaminated pasture or consuming contaminated feed and water can swallow some 200 different radioactive materials found in fallout particles. Among these is strontium 90, which is chemically similar to calcium. It concentrates in the bones and is secreted in the milk of dairy animals. Strontium 90 and other radioactive materials are an internal hazard to people who eat meat or drink milk from contaminated animals. To protect your livestock, make sure they have adequate shelter and clean water and feed.

Shelter

Specially constructed livestock fallout shelters or existing buildings with improved fallout protection give your livestock the most effective protection. The basement of a conventional two-story barn with a hay-filled loft makes a good shelter. If tightly constructed, such a structure can keep out more than 80 percent of outside

Table 5. Fallout protection values of farm buildings for livestock

Type of building	Radiation reduction (percent)	Nearest adequate downwind protection point (miles)
Large barns (50 x 80 x 35 feet high), *basement built into hillside*, with masonry walls, few windows, and 12 feet of baled hay in mow	95	100
Large barns with *masonry walls*, few windows, and 12 feet of baled hay in mow	90	120
Large barns with *wood frame* and full haymow	80	180
Medium-size two-story barns (30 to 50 feet long) of *wood construction* with empty mow (65 percent when mow is full). Any building similar to a two-story frame house	50	360
Large pole sheds and poultry houses	40	360
Small poultry and hog houses with normal openings	30	420
Small buildings with many openings	20	420
Open sheds with small lots	10	420
Open pasture	0	.....

radiation. Concrete buildings offer better protection than wooden ones. Nevertheless, a tight wooden barn can cut radiation exposure in half, and even a shed without sides gives some protection. Table 5 shows the amount of protection different types of buildings offer.

Let's assume a specific fallout situation in order to get a better idea of the value of farm buildings as fallout protection. Suppose your farm is directly downwind from the surface explosion of one 10-megaton nuclear weapon, and wind speeds at higher altitudes carrying fallout are 60 miles per hour. The third column in table 5 tells you how close to the explosion the building described gives adequate protection for cattle, sheep, or hogs. The second column tells how much the building reduces gamma radiation inside. Use the table to rate your own farm buildings as livestock fallout shelters.

Figure 18 will give you an idea of the amount of protection your cattle, sheep, or hogs would need depending on the location of your farm in this pattern.

Plan your livestock shelters now; there will not be time when fallout warning comes. First look over your existing farm buildings; then decide what you can do to improve them. If you decide to build a special shelter, see the plans prepared by the Minnesota Agricultural Extension Service (figures 19 and 20).

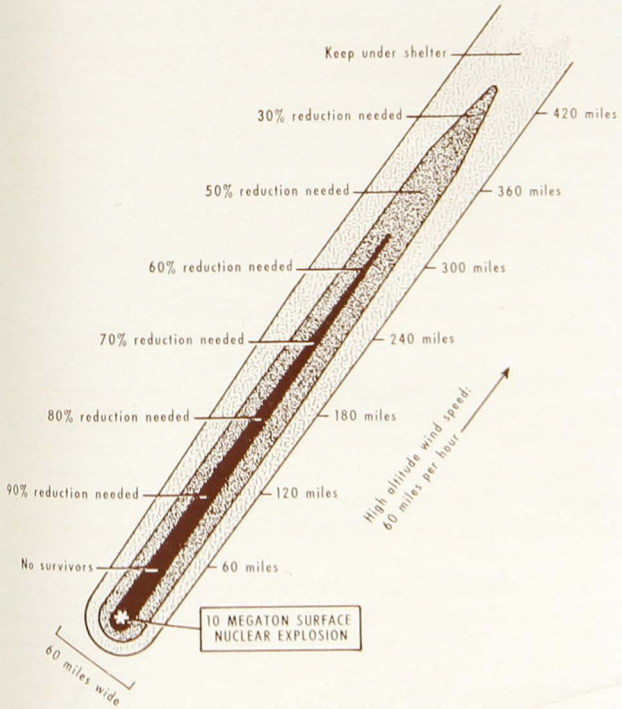

Figure 18. Percentages on the left indicate amount of fallout protection livestock would need in this idealized fallout pattern.

The 40-stall dairy barn pictured in the next column is designed for daily milk production and as an emergency fallout protection shelter for both family and herd. It is a good plan for fallout protection since, because it is used daily, its use in an emergency is familiar.

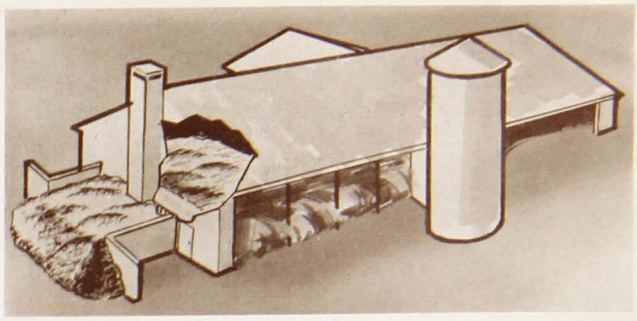

Figure 19. A combination of family fallout shelter and dairy barn.

The structure's combination of family shelter and dairy barn also facilitates the care of dairy cattle and since the building has its own power equipment, it can operate as an entity. It also has good overall fallout protection—a factor of 70 to 110 in the barn and more than 250 in the family shelter.

The shelter shown below provides low-cost adequate radiation protection for unattended animals. Although designed for beef cattle, it can be modified for sheep, hogs, poultry, or humans. If used for humans, the ends should be shielded and a ventilating system installed.

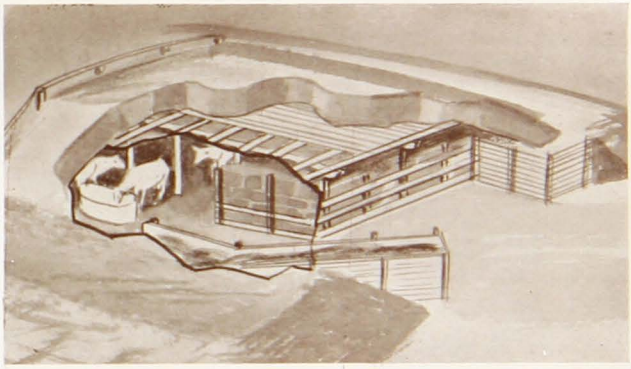

Figure 20. Adequate low-cost radiation protection for unattended animals is offered by this shelter.

The most desirable site for this shelter is on sloping ground near the pasture or lot where cattle are normally kept. Constructing it on a hillside makes surface water drainage easier and building it close to pastures or lots expedites herding animals into the shelter. The shelter's protection factor is about 90.

Plans for these shelters are available from the Minnesota Agricultural Extension Service for a small fee.

Trench silos can be converted into livestock shelters by building roofs over them and covering the roofs with earth. The protection of your barn can be increased by:

- Banking earth or hay against outside walls.
- Filling the loft with 12 or more feet of baled hay.
- Blocking off windows and other openings with baled hay, concrete blocks, sacks of grain, or sacks of feed.

● Installing a sprinkler system along the peak of the roof to wash off fallout.

The sprinkler system removes fallout from the roof so animals will not receive radiation from overhead. But fallout washed from the roof will give off radiation from the ground level and must be drained away. If fallout comes during freezing weather, sprinklers will be useless. Since electricity might be off, a standby generator is also needed to operate the sprinklers.

If it is impractical to improve the protection of your barn in advance, at least have materials and plans ready for improving protection quickly. **But remember that no one knows how much warning time you'll have for making last-minute preparations.**

Water, Feed, and Pasture

Even in heavy fallout areas, livestock can safely drink water from covered sources such as wells, cisterns, and springs. A few days after fallout stops, they may be able to drink water from large ponds, lakes, and creeks because fallout particles will have settled to the bottom. Let USDA authorities check these open sources before allowing livestock to use them. If uncontaminated water is scarce, cut down the amount of feed you give livestock. Most animals can live 4 or 5 days without water if they are not fed. As a last resort, let livestock drink contaminated water rather than die of thirst.

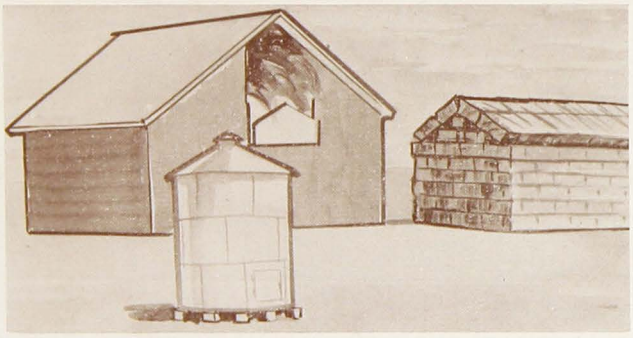

Figure 21. Covered feed is protected from radioactive fallout and is safe for livestock.

Any cover that protects feed from dust protects it from fallout. Grain stored in a permanent bin, silage stored in a covered silo, and hay stored in a tight barn are well protected and can be used when you can reach them safely. Haystacks covered with tarpaulins or similar covers can also be used because fallout will be only on the covers, not in the feed. Fallout that settles directly on haystacks will contaminate only the outer portions. By carefully removing contaminated outer layers, you can use inner layers safely. Do not handle contaminated feed until authorities say it is safe to do so, and be sure to follow any precautions they recommend. If supplies of uncontaminated feed are limited, use them for milk cows and breeding animals.

USDA authorities will notify you when pastures become safe for grazing. In heavily contaminated areas this may take some time. It is best to house livestock without giving them access to pastures for as long as uncontaminated feed lasts. But it is better to keep animals alive on contaminated feed and pasture than let them die of starvation.

Dairy Cattle

Dairy cows should receive special attention because radioactive materials accumulate in milk. Keep them in the best available shelter and give them clean feed and water. If time permits after you receive fallout warning, milk them. Reduce their feed and water to maintenance levels and, if practicable, put young calves with cows to reduce the discomfort of full udders.

You may have to give cows contaminated feed if no other feed is available. Although milk from these cows may be unusable, once they are back on uncontaminated feed the amount of radioactive material in their milk will decrease rapidly. Some contaminated milk may be processed and stored until, because of radioactive decay, little radioactivity remains. Authorities measuring fallout will warn you when milk is unsafe, but warning may be delayed in areas where fallout is heaviest.

Poultry

Poultry have a greater chance of surviving fallout than other animals because they are more resistant to radiation and they are accustomed to shelters. Also, most poultry feed on bagged grain stored under shelter. Even if hens eat contaminated feed, most of the radioactive materials in their eggs would collect in the shells. Therefore, poultry would be an important source of uncontaminated protein following a nuclear attack.

What You Can Do

Now

Plan to carry out your farm protection measures in steps. Make the most essential preparations such as choosing shelter areas now and other preparations according to a specific schedule. Make separate plans for summer and winter emergency situations. In addition, figure out specific tasks to be done when you receive

Figure 22. Farm survival calendar

FARM SURVIVAL CALENDAR

(Your name and address) (Date of plan)

When	Who	Helpers or alternates		What	Where	How
		1st	2nd			

Figure 22. The top of your survival calendar may look like this.

warning, when fallout arrives, and after you can leave the shelter.

Write your plans down clearly so your family and workers will understand, remember, and correctly carry them out. A checklist posted on the inside of your barn door can tell who is to do what, when, where, and how. Its headings might look like those in figure 22.

As you complete your plan, give each step a thorough testing to reveal weaknesses and allow for improvement ideas. Review, revise, and retest your plan periodically so you can be sure it is your best protective action.

Here are some steps you should plan:

Provide shelter, food, and water for your family and workers.

Decide which shelter areas to use for livestock and how they can be improved. Plan to keep dairy cows in the best shelter area, breeding animals in the next best, and less valuable animals in whatever is still available. Keep any animals that must be left outside in small enclosed lots near farm buildings to simplify care and observation.

Plan an efficient procedure for getting livestock into shelter quickly when fallout warning comes.

Store feed and grain in weatherproof buildings. Place silage pits and haystacks close to livestock shelters and provide self-feeders or racks large enough to meet animal needs for 2 or 3 days.

Protect as large a water reserve as possible. Keep your well clean and covered. Put rainwater barrels and other containers near shelters, fill them regularly, and keep them covered.

Provide an auxiliary generator so there will be electric power even if commercial power is off.

Keep extra batteries and tractor fuel on hand.

When You Receive Fallout Warning

First make sure your family is protected, then:

- Get livestock into shelter quickly.
- Give stock enough feed and water for a few days. If water is limited, limit feed also.
- Protect feed supplies by closing granary doors and covering any feed left outside.
- Carry out last-minute shelter improvement plans such as blocking windows and doors with concrete blocks or baled hay.
- Milk cows and reduce their feed to maintenance levels.
- Move farm machinery and equipment indoors or cover them to reduce decontamination problems.

Above all, do not take chances with fallout. Never unnecessarily expose yourself, your family, or workers to radiation.

Figure 23. When fallout warning comes, get livestock under shelter quickly.

When You Can Go Outside

Civil defense authorities will notify you when and for how long it is safe to leave your shelter. At first the length of time you can remain outdoors will be short but it will increase as fallout decays.

To efficiently carry out chores and cleanup operations, plan a work schedule each evening. Your guiding principle in planning these schedules should be to **keep radiation exposure at the lowest practical limit.** Schedules will vary with radiation intensity and the urgency of your tasks. Postpone all but the most urgent tasks as long as possible to take advantage of radioactive decay. Whenever possible, divide work among adults to keep everyone's exposure time down. Because exposure to radiation can increase the probability of genetic defects and may have harmful effects in later life, adults past the reproductive age should perform tasks involving exposure.

Try to keep your total radiation dose below 50 roentgens. This is less than the amount causing detectable radiation injury. Table 6 is an example of a daily outdoor work schedule. It expresses radiation exposure as equivalent residual dose (ERD). This is the difference between total exposure to radiation and amount of healing that has taken place. ERD can be called the unhealed portion of radiation injury. Let's assume a farmer has a basement fallout shelter and is 120 miles downwind in the middle of the fallout pattern shown in figure 24. Beginning on the 4th day after the attack he could be outside 1 hour each day until the 14th day and keep his ERD below 50 roentgens. If he were only 60 miles away he would need an underground shelter in order to work outside and still keep his total exposure at a minimum.

Caution: Do not depend on table 6 as your guide if fallout occurs. It is only a reasonable example based on specific wind conditions.

Table 6. Daily outdoor emergency work schedule

Shelter during indoor hours	Location in fallout pattern	Distance downwind (miles)	ERD°	Days after explosion: 1	2	3	4	5-14
				Hours outdoors per day				
Underground shelter (PF† = 1,000)	Inner black area	60	50	0	0	0	1	1
			100	0	0	1	2	1
		120	50	0	0	0	1	3
			100	0	1	2	3	4
Basement shelter (PF=100)	Inner black area	60	50	*not enough protection*				
			100	0	0	0	0	½
		120	50	0	0	0	1	1
			100	0	1	2	2	3
		240	50	0	1	1	1	4½
			100	0	2	4	8	8
	Intermediate area		50	0	2	2	2	8
			100	0	12	12	12	12
Basement (PF=10)	Inner black area	240	50	*not enough protection*				
			100	0	0	0	0	3
	Intermediate area		50	0	0	1	1	1
			100	0	2	4	8	8
First floor of house (PF=2)	Outer area			0	*usual hours outdoors*			

° Equivalent Residual Dose: See text.

† Protection Factor: Outside dose rate in roentgens per hour necessary to produce 1 roentgen per hour in shelter.

You will need radiation measuring instruments to keep track of exposure. In order to be outside safely your inside hours should be spent in the best shelter available. If your work is in livestock buildings, exposure will be less than that outdoors and your work time can be longer.

Caution: If you absolutely must go outside before fallout is down, wear dusttight clothes. Take them off before reentering the shelter and wash exposed skin to remove fallout thoroughly.

During these periods you can perform regular chores and begin cleanup operations. You may be advised to hose down and scrub animals directly exposed to fallout and to scrub out stables, barns, and other buildings. When handling animals, wear coveralls, gloves, and boots.

Some animals may die from radiation sickness a short time after exposure. Their carcasses will probably not be dangerous and can be buried safely. If fallout is heavy, USDA officials will issue special instructions for your protection in handling contaminated carcasses. Don't slaughter animals with symptoms of radiation sickness unless authorities advise it. Separate these animals from the herd as radiation sickness will make them more susceptible to other diseases that could spread.

After an attack, your healthy animals may be needed for food. Meat from animals exposed to fallout will usually be safe if animals are slaughtered 2 to 8 days after exposure or recovery from radiation sickness. Slaughter only those animals that appear healthy and have normal temperatures. Handle carcasses carefully to avoid transferring fallout from hide and intestines to meat. Discard all internal organs.

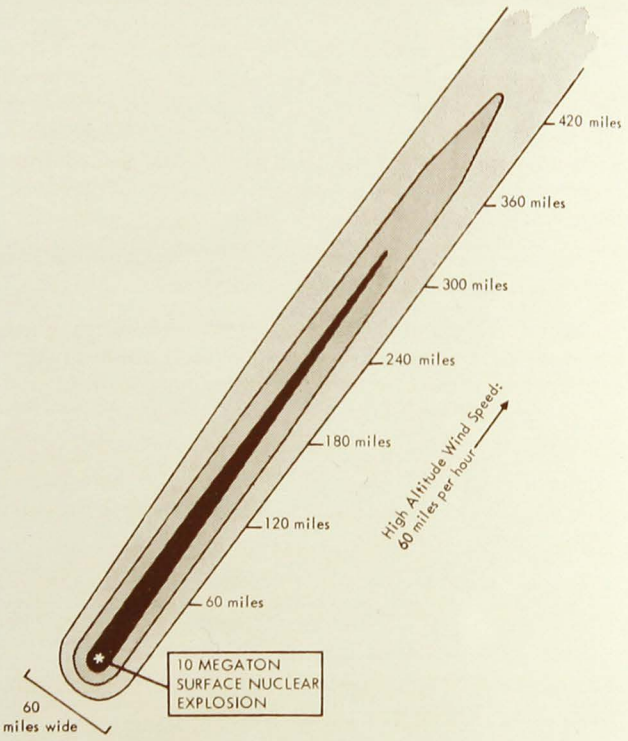

Figure 24. An idealized fallout pattern caused by one nuclear explosion and spread by one set of specific wind conditions.

Postattack Care of Crops and Soils

After a massive attack fallout will contaminate large areas of cropland. In heavy fallout areas, farming procedures will have to be altered drastically until radiation disappears. In lightly affected areas, normal farming can be continued as crops will be affected very little.

How long radiation affects crops and soil in an area depends upon the amount of fallout. Some radioactive materials decay rapidly and will not be hazardous after a few days but some, including strontium 90, decay very slowly and will exist for years.

Figure 25. Combining and threshing will remove fallout dust.

Standing Crops

Whether or not you can save standing crops depends on their stage of growth when fallout occurs and how long you must wait before harvesting them. Crops ready for harvesting when fallout occurs might be lost because it may be too dangerous to expose workers to radiation, but you may be able to save crops approaching maturity when fallout occurs.

You might have to monitor grain before using it. However, since premilling, threshing, and cleaning processes are designed to remove dust, most fallout particles will be removed with it. USDA agencies will provide guidance concerning crop decontamination. They will also tell you which crops, pasturage, and methods are safest to use.

Growing Crops in Contaminated Soil

Crops growing in contaminated soil will absorb some long-lived radioactive materials. The most hazardous of these is strontium 90 which is absorbed in place of or along with calcium. It is absorbed in different amounts and stored at different locations by various species. Strontium can be absorbed by successive crops for several years.

Figure 26. USDA technicians will measure radiation danger on farmland and livestock after a nuclear attack.

The definite effects of eating food containing strontium are not known, but it is suspected that bone cancer and leukemia are two of them. Therefore, though you will not be expected to raise entirely uncontaminated crops, it is important that your food crops be low in strontium. To do this, soil contamination must be reduced.

Heavily Contaminated Soil

Do not undertake drastic decontamination measures unless USDA authorities determine that your land is excessively radioactive. If it is, you may be advised to leave it idle or to substitute nonfood crops until strontium has decayed to a safe level. Although deep plowing or scraping off the top layer of soil is too expensive and impractical for large areas, either method can be used if a small plot of highly contaminated land is needed. Scraped off soil should be buried in an isolated area that does not drain into a water supply.

Your soil may be contaminated at a level that makes it unsafe for some crops but safe for others. In this case, you may be advised to substitute low-calcium-content crops such as potatoes, corn, sugar beets, and oil crops. Pastures unsafe for dairy cattle may be safe for beef cattle and other meat animals since strontium collects in their bones, not in their muscles. However, meat produced on contaminated land will have to be boned, closely inspected, and monitored before use.

Place heavily contaminated land in production only when its use is absolutely necessary. The degree of decontamination it will need will depend on the crop to be grown and the availability of manpower, fuel, and equipment.

Lightly Contaminated Soil

The most effective ways to treat lightly contaminated soil are by fertilization or by removing ground cover.

If you normally lime and fertilize your soil for greater crop yields, continue to use the same amounts to reduce strontium uptake by plants. Lime applied to acid or infertile soil might reduce the strontium absorbed by as much as two-thirds. Using lime on neutral or alkaline soil will not reduce strontium absorption significantly. Use no more lime than is needed for optimal plant growth.

Adding potassium, crop residues, and manure will also reduce the amount of radioactive materials plants absorb. Your county agent will recommend the amount of fertilizer to use per acre. Because fertilizers may be scarce during an emergency, the Department of Agriculture will control their sale and distribution. Your county Agricultural Stabilization and Conservation Service office will help you obtain what you need.

Decontamination by removing crop residues is especially effective when the cover is thick. Standing grain and cultivated crops retain about 10 to 30 percent of deposited fallout. By carefully removing these contaminated crops with conventional harvesting equipment, you will also remove fallout. Standing crops provide a less complete ground cover than mulches. If the latter are on the ground when fallout begins, they form a cover that may retain up to 90 percent of the fallout.

Safe disposal of contaminated mulch and crop residues is important. You can reduce their bulk by baling and burning them, but their ashes must be buried where they cannot affect a water supply.

Crop Contamination by Irrigation Water

Irrigation water will deposit little radioactive material compared to the amounts deposited by direct fallout. But make sure the water in your irrigation sprinklers is as safe as your drinking water.

Care of Farm Machinery

For harvesting and decontaminating crops after fallout, your farm equipment must be in good repair and you must have fuel and lubricants. So an early step in your plan should be to make sure all equipment is functioning properly. During a widespread disaster, USDA will control the sale of farm equipment and repair parts, and you might have to obtain a use certificate from the county Agricultural Stabilization and Conservation Service before purchasing them.

Figure 27. Keep reserve supplies of fuel and necessary farm equipment on hand for emergencies.

Store a 14-day reserve of fuel and lubricants for your tractor, truck, automobile, and small engines. To determine how much fuel you need for 14 days, check last year's fuel bills for the 2-week period in which you used the most fuel. Provide storage facilities for this and the amount you normally use between deliveries. If you have an underground tank with an electric fuel pump, equip it with a substitute means of pumping fuel. Equip gravity tanks with automatic shutoff valves; make sure all aboveground tanks are at least 40 feet from buildings.

When fallout warning comes, move unprotected vehicles and equipment into farm buildings and close the windows and doors of both. If some equipment must remain outside, cover it with tarpaulins or plastic.

Make Your Plans Now

If disaster strikes, your emergency plans will be a great help and comfort to you and your family. Although you hope your plans will never be used, the possibility of an emergency, natural or manmade, must be admitted. Plan with your family the jobs each person will have during a disaster. Then, if an emergency does arise, your chances of survival will be much better.

For more information on family and farm survival, ask your county agricultural agent or local civil defense director for these brochures:

Fallout Protection—What to Know and Do About Nuclear Attack, Department of Defense, Office of Civil Defense, H-6.

Family Fallout Protection Rating Guide, University of of Minnesota, RCD 3.

Family Food Stockpile for Survival, USDA, Home and Garden Bulletin No. 77.

Family Shelter Designs, Department of Defense, Office of Civil Defense, H-7.

Radioactive Fallout on the Farm, USDA, Farmers' Bulletin No. 2107.

Your Family Survival Plan, USDA, PA-578.

The information given herein is supplied with the understanding that no discrimination is intended and no endorsement is implied.

Table 7. Shelter supplies and equipment

Check what you have, get what you need

Indicate person(s) responsible	Have on hand	Stored in shelter	Take into shelter
Cooking and serving			
_____			
Camp stove and fuel or canned heat			
Pots, pans, skillet			
Paper plates, cups, napkins			
Can opener			
Serving utensils			
Serving dishes			
Aluminum foil			
Matches			
Soap powder, dish towels			
_____			
_____			
_____			
Lighting			
_____			
Flashlight, batteries			
6-volt dry cell lantern			
Candles			
_____			
Sleeping			
_____			
Cots, bunks, or sleeping bags			
Blankets			
Plastic covers			
_____			
_____			
Communication and radiation detection			
_____			
Portable radio, extra batteries			
Radiation meters			
_____			
Sanitation			
_____			
Large garbage can			
Covered pail			
Paper bags, plastic bags			
Toilet tissue			
Disinfectant			
Deodorizers			
Insecticide			
Sanitary napkins			
_____			
_____			

Indicate person(s) responsible	Have on hand	Stored in shelter	Take into shelter
Clothing			
_____			
Warm clothes			
Boots			
Coveralls for outdoor work			
_____			
_____			
Food and water			
_____			
(see table 8)			
Personal supplies			
_____			
Deodorant			
Soap, towels, washcloths			
Toothbrushes, toothpaste			
Shaving equipment			
Dry shampoo			
_____			
_____			
Medical supplies			
_____			
First aid kit			
Prescription medicine			
_____			
Recreational supplies			
_____			
_____			
_____			
_____			
Baby supplies			
_____			
_____			
_____			
Other items			
_____			
Sewing kit			
Broom			
Screwdriver, pliers			
Hatchet, shovel			
Firefighting equipment			
Clock, calendar			
String or rope			
_____			
_____			

Table 8. Guide for reserve food supply*

Food	Amount per person for 1 day	Amount per person for 2 weeks	Number of servings per container (commercially canned foods usually have the number of servings printed on the container)
Dairy products	(adults)		
Milk	2 cups	7 quarts	Evaporated milk
	(teenagers)		Three 6-ounce cans = 1 quart
	4 cups	14 quarts	One 14½-ounce can = about 1 quart
	(children)		Nonfat dry milk
	3 cups	10 quarts	One 1-pound container = 5 quarts
Powdered cream		Two 7-ounce jars	
Cheese spreads		Two 6-ounce jars	
Meat or equivalents	2 servings or 1 cup	28 servings or 14 cups (7 pints or pounds)	
Meat; fish; poultry; baked beans; mixtures of meat, vegetables, and cereals such as spaghetti and meat balls or chow mein (all commercially canned)	Caution: some canned hams must be refrigerated.		
Fruits and vegetables	3 to 4 servings	42 to 56 servings (10 to 16 pints or pounds)	
Condensed vegetable soups, canned berries, canned citrus fruits and juices, dried fruits, instant potatoes, canned tomatoes, other canned fruits and vegetables			
Cereals and baked goods	3 to 4 servings	42 to 56 servings (10 to 16 pints or pounds)	
Uncooked cereals, canned baked items, crackers, rusks, Melba toast			
Fats and vegetable oils	Up to 1 pint or pound (Amount depends on extent of cooking possible. Store those requiring no refrigeration.)		
Sugars, sweets, nuts			
Sugar, hard candy, gum, nuts, instant pudding, jelly or jam, peanut butter	1 to 2 pounds		
Miscellaneous	According to family practices and extent of cooking possible.		
Coffee, tea, cocoa (instant), bouillon products, flavored beverages (powdered), salt and pepper, special diet foods			
Water	½ gallon	7 gallons	

Standard can sizes

Size	Servings	Cups
6 ounce	1½	¾
8 ounce	2	1
No. 1	3 to 4	1¼
No. 2	4 to 5	2½
No. 2½	6 to 7	3½
No. 3	8 to 12	5¾
No. 300	3 to 4	1¾
No. 303	4	2
No. 10	25	12

* The amounts recommended in this table are based on a daily diet of 2,000 calories. Most people can subsist on one-half to two-thirds of these amounts for up to 2 weeks.

Table 9. Our family food reserve

Foods needed for our family _____ persons	Amount needed for 2 weeks _____ persons*	Amount stored	Where stored	Date purchased
Dairy products				
Milk				
Powdered cream				
Cheese spreads				
Meat or equivalents				
Meat				
Fish				
Poultry				
Fruits and vegetables				
Condensed vegetable soups				
Canned fruits and berries				
Canned fruit juices				
Dried fruits				
Instant potatoes				
Canned vegetables				
Cereals and baked goods				
Uncooked cereals				
Canned baked goods				
Crackers, rusks, Melba toast				
Fats and vegetable oils				
Sugars, sweets, nuts				
Sugar				
Hard candy				
Gum				
Nuts				
Instant pudding				
Jelly or jam				
Peanut butter				
Miscellaneous				
Coffee				
Tea				
Cocoa				
Flavored beverages				
Bouillon products				
Salt and pepper				
Special diet foods				

* To determine the amounts of various foods your family needs, multiply the number of persons in your family by the amount needed per person for 2 weeks found in column two of table 8.

Table 10. Suggested first aid kit

For these purposes	Use these	Or these	Suggested quantity
Open wounds, scratches, or cuts	Antiseptic solution: Benzalkonium chloride solution, U.S.P., 1 to 1,000 parts of water.	Quarternary ammonium compounds in water. Sold under trade names such as Zephirin, Phemerol, Ceepryn, and Diaprene chlorides.	3- to 6-ounce bottle
Faintness	Aromatic spirits of ammonia. Adult dose ½ teaspoon in cup of water; children 5 to 10 drops in ½ glass of water. As smelling salts, remove stopper, hold bottle under nose.	Inhalation aromatic ammonia ampules.	1- to 2-ounce bottle
Shock	Table salt and baking soda: dissolve 1 teaspoon salt and ½ teaspoon baking soda in 1 quart water. Have person drink as much of it as he can. Don't give to unconscious or semiconscious person.	Sodium chloride tablets (10 grain, 50 tablets in bottle) and sodium bicarbonate or sodium citrate tablets (5 grain, 50 tablets in bottle). Dissolve six 10 grain sodium chloride tablets and six 5 grain sodium bicarbonate tablets in 1 quart water.	1 box each
A sling; as a cover; for a dressing	Triangular bandage, folded, sterile, 37″ x 37″ x 52″ with 2 safety pins.	Muslin or other strong material. Cut to exact dimensions. Fold and wrap each bandage and 2 safety pins separately in paper.	4 bandages
Open wounds or dry dressings for burns	Sterile gauze squares (individually wrapped 3″ x 3″) and 1- and 2-inch gauze roller bandages.	None.	6 squares—1 roll each
Eye irritations	Eye drops. Use two drops in each eye. Apply cold compresses every 20 minutes if possible.	None.	½- to 1-ounce bottle with dropper
Minor burns	Petroleum jelly in tube.	Burn ointment.	1 tube
Splinting broken fingers or other small bones, for stirring solutions	Wooden tongue blades.	Shingles, pieces of orange crate or other light wood cut to about 1½″x6″.	12
Purifying water when it cannot be boiled (radioactive contamination cannot be neutralized or removed by boiling or disinfectants)	Water purification tablets (iodine, trade names—Globaline, Bursoline) or household bleach solution (about 5 percent available chlorine), 3 drops per quart.	Tincture of iodine or iodine solution (3 drops per quart).	Bottle of 50 or 100 1 small bottle
Administering stimulants or liquids	Paper drinking cups.		25 to 50
Holding bandages in place	Safety pins, 1½-inches long.		12 to 15
Cutting bandages or dressing, removing clothing from injured body surface	Single edge razor blades, scissors.	Sharp knife.	3
Cleansing skin	Liquid or cake soap containing hexachlorophene.	Any mild soap.	1 bar or small bottle
Measuring or stirring solutions	Measuring spoons.		1 set